DOCUMENT RESUME

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ABSTRACT

Rube Goldberg is famous for his very complex machines that accomplish everyday tasks. In this activity, students design and build a Rube Goldberg machine that will accomplish a simple task in no less than 10 steps. This activity requires a 120-360 minute time period for completion. (Author/SOE)

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ED 480 794

Activity: **Design Your Own Rube Goldberg Machine**

GRADE LEVELS: 6-8

SUMMARY:

Rube Goldberg is famous for his very complex machines that accomplish everyday tasks. Students will design and build a Rube Goldberg machine which will accomplish a simple task in no less than ten steps.

LEVEL OF DIFFICULTY [1 = Least Difficult: 5 = Most Difficult]

4-difficult

TIME REQUIRED

120 – 360 minutes (2-8 class periods)

COST

variable

STANDARDS:

2.2 Demonstrate methods of representing solutions to a design problem, e.g., sketches, orthographic projections, multiview drawings.

2.3 Describe and explain the purpose of a given prototype.

2.4 Identify appropriate materials, tools, and machines needed to construct a prototype of a given engineering design.

2.5 Explain how such design features as size, shape, weight, function and cost limitations (i.e., ergonomics) would affect the construction of a given prototype.

2.6 Identify the five elements of a universal systems model: goal, inputs, processes, outputs, and feedback.

1.1 Given a design task, identify appropriate materials (e.g., wood, paper, plastic, aggregates, ceramics, metals, solvents, adhesives) based on specific properties and characteristics (i.e., weight, strength, hardness and flexibility).

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1.2 Identify and explain appropriate measuring tools, hand tools, and power tools used to hold, lift, carry, fasten, and separate, and explain their safe and proper use.

1.3 Identify and explain the safe and proper use of measuring tools, hand tools, and machines (e.g., band saw, drill press, sanders, hammer, screwdriver, pliers, tape measure, screws, nails, and other mechanical fasteners) needed to construct a prototype of an engineering design.

WHAT WILL THE STUDENTS LEARN?

Practical representation of simple machines (prototype)

Engineering design process

Safe usage of tools

Five elements of a technology system – goal, inputs, processes, outputs and feedback

BACKGROUND INFORMATION:

Schematic: showing the basic form or layout of something

Students should already have had an introduction to simple machines: lever, pulley, wheel and axle, wedge, inclined plane, etc.

Students should already be trained to use any tools they will need. Screwdrivers, saws, drills hammers and other necessary tools.

For 55 years Goldberg's award-winning cartoons satirized machines and gadgets which he saw as excessive. His cartoons combined simple machines and common household items to create complex, wacky, and diabolically logical machines that accomplished mundane and trivial tasks. His inventions became so widely known that Webster's Dictionary added "rube goldberg" to its listing, defining it as "accomplishing by extremely complex, roundabout means what seemingly could be done simply."

His "inventions," drawn for our pleasure, can actually work. By inventing excessively complex ways to accomplish simple tasks, he entertained us and poked fun at the gadgets designed to make our lives easier. In his words, the machines were a "symbol of man's capacity for exerting maximum effort to achieve minimal results." He believed that most people preferred doing things the hard way instead of using simpler, more direct paths to accomplish goals.

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The resulting inventions are collections of bits and pieces, parts of now useless machines, scraped together to achieve an innovative, imaginative, yet somehow logical contraption to conquer the job at hand.

-Taken from www.rubegoldberg.com

RECOMMENDED RESOURCES:

www.rubegoldberg.com

The New Way Things Work by David Macaulay

http://www.fi.edu/qa97/spotlight3/spotlight3.html Pictures and explanations of simple machines.

MATERIALS:

Examples of simple and complex machines (pullys, ramps, bicycle etc.)

Illustrations of Rube Goldberg machines

Wood, metals, plastics and composites.

Foam board or extruded foam insulation make good bases as they are light, sturdy, and easy to attach things to.

Coat hangers, cardboard, screws, wire, string, tape and lots of other miscellaneous construction materials.

Screwdrivers, saws, drills hammers and other necessary tools.

Poster paper, markers, crayons, pencils, rulers, etc

Collection of discarded "raw materials" for student prototypes

Students will also need to provide materials from home, which may be returned at the end of the project.

PREPARATION:

Choose time frame for completion of machine

Gather materials and/or have students gather materials in advance.

DIRECTIONS:

As a class:

1. Review simple machines

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2. Brainstorm on the incorporation of simple machines into more complex machines

3. Brainstorm simple tasks that would lend themselves to the project

4. Look at illustrations of Rube Goldberg machines

5.Discuss any saftey concerns that the students need to be aware of reguarding the supplies availible to them.

6.Explain requirements and expectations for the rubric.

7. Divide students into groups.

8. Students will identify a basic task and design a machine to accomplish that task in no less then 10 steps.

9. Students will produce a schematic design labeling each part and its function and each step needed to accomplish the task.

10. Students will build a working prototype of their design using tools and machinery.

11. Students will make a presentation of their prototype which will include a demonstration and explanation of the process.

INVESTIGATING QUESTIONS:

How can we build a device that will incorporate the recognized standard simple machines and will accomplish a basic task in no less then 10 steps?

How can we represent the process used to complete this design from goal to feedback?

Does the prototype accomplish the basic task in no less then 10 steps?

How does the prototype work to accomplish this task in no less then 10 steps?

Does or could this prototype have a practical application?

What changes would we make to the prototype based on our experiences – successes and failures - during the design process?

How do we use tools to shape, cut, and/or fabricate elements of the design?

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REFERENCES:

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Students can enter designs in the annual Rube Goldberg Machine Contest. For current information, contact Rube Goldberg Inc at www.rubegoldberg.com or (212) 371 3760.

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Rubric for Performance Assessment						
Activity Title:	Rube Goldberg Machine Design			Grade Level		
	1	2	3	4		
Criteria	Beginning	Developing	Proficient	Advanced	Weight (X factor)	Subtotal
DESIGN	Design is crude, barely recognizable. Labels are sparse and machine drawn does not accomplish task or has very few steps.	Labels are incomplete, or unclear, machine does not have enough steps.	Labels explain each part of the machine and its function and each step needed to accomplish the task. Machine uses 10 steps. Drawing clearly matches prototype.	Machine parts explained clearly and in detail. Machine has more steps than necessary		
CONSTRUCTION AND DEMONSTRATION	Machine is badly built, will not work. Tools are used unsafely or	Machine does not have enough steps.	Machine is sturdy, has 10 steps. Tools are used properly	Machine is sturdy and has more than 10 steps, is cleverly designed		
PRESENTATION	Student cannot explain the function of the machine	Student gives some explanation of machine function, but it is not clear.	Student explains function of each step, and it is clear how the machine works. Presentation is organized.	Student explains function of each step, simple machines involved, how they are used to make a complex machine		
					Total:	
Teacher Comments:						

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Names_____

_____

Sketch your design for a Rube Goldberg machine and label its parts.

What is the ultimate goal for your machine? -

_____

What simple machines did you incorporate?

_____

Did you use 10 steps? _____

List and describe the steps

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PreK-12
ENGINEERING

Activity Evaluation Form www.k12engineering.org

Activity Name: _____

Grade Level the Activity was implemented at: _____

Was this Activity effective at this grade level (if so, why, and if not, why not)?

What were the Activity's strong points?

What were its weak points?

Was the suggested Time Required sufficient (if not, which aspects of the Activity took shorter or longer than expected)?

Was the supposed Cost accurate (if not, what were some factors that contributed to either lower or higher costs)?

Do you think that the Activity sufficiently represented the listed MA Framework Standards (if not, do you have suggestions that might improve the Activity's relevance)?

Was the suggested Preparation sufficient in raising the students' initial familiarity with the Activity's topic (if not, do you have suggestions of steps that might be added here)?

If there were any attached Rubrics or Worksheets, were they effective (if not, do you have suggestions for their improvement)?

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I. DOCUMENT IDENTIFICATION:

Title: PreK-12 Engineering Activities

1) Touch and Discover, Grades PreK-2
http://www.prek-12engineering.org/data/d2/Touchdiscover.pdf

2) Invent a Backscratcher from Everyday Materials, Grades PreK-2
http://www.prek-12engineering.org/data/d28/Backscratcher.pdf

3) Compare Human-Made Objects with Natural Objects, Grades PreK-5
http://www.prek-12engineering.org/data/d34/HumanvsNatural.pdf

4) Do Different Colors Absorb Heat Better?, Grades PreK-2
http://www.prek-12engineering.org/data/d37/Absorbheat.pdf

5) Which Roof is Tops?, Grades PreK-2
http://www.prek-12engineering.org/data/d44/RoofTops.pdf

6) Make Your Own Recycled Paper, Grades PreK-2
http://www.prek-12engineering.org/data/d56/Recycle.pdf

7) Build an Approximate Scale Model of an Object Using LEGOs, Grades 3-5
http://www.prek-12engineering.org/data/d3/LegoScaleModel.pdf

8) Design Weather Instruments using Lego Sensors, Grades 3-5
http://www.prek-12engineering.org/data/d4/LegoWeather.pdf

9) Space Shelter, Grades 3-5
http://www.prek-12engineering.org/data/d5/SpaceShelter.pdf

10) Build a Bird House, Grades 3-5
http://www.prek-12engineering.org/data/d6/BirdHouse.pdf

11) Ball Bounce Experiment, Grades 3-5
http://www.prek-12engineering.org/data/d6/BallBounce.pdf

12) Make an Alarm!, Grades 3-5
http://www.prek-12engineering.org/data/d11/MakeAlarm.pdf

13) Design Packing to Safely Mail Raw Spaghetti, Grades 3-5
http://www.prek-12engineering.org/data/d17/MailSpaghetti.pdf

14) Disassemble a Click Pen, Grades 3-5
http://www.prek-12engineering.org/data/d33/clickPen.pdf

15) Construct And Test Roofs for Different Climates, Grades 3-5
http://www.prek-12engineering.org/data/d35/ClimateRoof.pdf

16) Compare Fabric Materials, Grades 3-5
http://www.prek-12engineering.org/data/d36/Fabric.pdf

17) A House is a House for Me, Grades 3-5
http://www.prek-12engineering.org/data/d52/House.pdf

18) Water Filtration, Grades 3-5
http://www.prek-12engineering.org/data/d53/Water Filtration.pdf

19) What is the Best Insulator: Air, Styrofoam, Foil, or Cotton?, Grades 3-5
http://www.prek-12engineering.org/data/d54/BestInsulator.pdf

20) Design a Recycling Game!, Grades 3-5
http://www.prek-12engineering.org/data/d55/Recycling.pdf

21) Tower Investigation and the Egg, Grades 6-8
http://www.prek-12engineering.org/data/d7/TowerEgg.pdf

22) Wimpy Radar Antenna!, Grades 6-8
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23) Portable Sundial, Grades 6-8
http://www.prek-12engineering.org/data/d30/PortableSundial.pdf

24) An Introduction To Loads Acting on Structures, Grades 6-8
http://www.prek-12engineering.org/data/d31/IntroLoads.pdf

25) Design Your Own Rube Goldberg Machine, Grades 6-8
http://www.prek-12engineering.org/data/d32/RubeGoldberg.pdf

26) Building Tetrahedral Kites, Grades 6-8
http://www.prek-12engineering.org/data/d38/tetrakites.pdf

27) Do as the Romans: Construct an Aqueduct!, Grades 6-8
http://www.prek-12engineering.org/data/d39/Aqueduct.pdf

28) Build an Earthquake City!!, Grades 6-8
http://www.prek-12engineering.org/data/d40/EarthquakeCity.pdf

29) Design a Parachute, Grades 6-8
http://www.prek-12engineering.org/data/d41/Parachute.pdf

30) The Squeeze is On, Grades 6-8
http://www.prek-12engineering.org/data/d42/Squeeze.pdf

31) Stop The Stretching, Grades 6-8
http://www.prek-12engineering.org/data/d43/StopStretching.pdf

32) Speaker Project, Grades 9-10
http://www.prek-12engineering.org/data/d13/Speaker.pdf

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